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Non-Profit Law and Science for Global Resource Solutions

November 28, 2007

Phil Isenberg, Chair
Delta Vision Blue Ribbon Task Force
c/o California Bay-Delta Authority
650 Capitol Mall, 5th floor
Sacramento, CA 95814

RE: 11/19/07 DELTA VISION DRAFT

Dear Chairman Isenberg,

The Natural Heritage Institute is pleased to present these comments and recommendations regarding the third draft of the Delta Vision. NHI is a non-profit, natural resources conservation organization whose core mission is to restore and protect water-dependent ecosystems in California and worldwide. NHI serves on both the Steering Committee for the Bay Delta Conservation Plan and on the Stakeholder Coordination Group of the Delta Vision process.

NHI finds much wisdom in the Vision statement and commends the Task Force for its clear and expansive vision for the future of the Delta. Although conveyance is only one piece of the larger Delta vision, it is nearly impossible to solve the other elements puzzle without resolution on the configuration of water diversion and conveyance infrastructure.

NHI believes the preferred alternative to be option (a) – *dual-conveyance* – as more fully articulated in Paragraph 2.3 of the Bay Delta Conservation Plan's "Points of Agreement"[1] document—conditional upon satisfactory arrangements as to its design, operations and governance to assure that the expanded flexibility (and capacity) to export water from the estuary will alleviate rather than increase stresses

[1] *Conveyance Facilities:* "The Steering Committee agrees that the most promising approach for achieving the BDCP conservation and water supply goals involves a conveyance system with new points of diversion, the ultimate acceptability of which will turn on important, design, operational and institutional arrangements . . . . The main new physical feature of this conveyance system includes the construction and operation of a new point of diversion in the north Delta on the Sacramento River and an isolated conveyance facility around the Delta. Modifications to existing south Delta facilities to reduce entrainment and otherwise improve the State Water Project (SWP) and Central Valley Project (CVP) ability to convey water thought the Delta while contributing to near and long-term conservation and supply goals will also be evaluated. * * *

on the ecosystem. These assurances, or other compensatory mechanisms, should also be mindful of the unsustainability of delta agriculture if its water quality or the integrity of the levee system is allowed to deteriorate.

The rationale for this recommendation is set forth at length in the attached analysis by NHI. We also think it is highly desirable to the success of both the BDCP and Delta Vision that they coalesce on the same choice of conveyance infrastructure. Finally, we are unenthusiastic about a temporizing alternative which would once again defer action in the face of an apparent ecological crisis in favor of additional study, as would options (c) and (d). This is where the Cal Fed process stalled out seven years ago. It is also too reminiscent of the paralysis at the national level while the global climate change crisis becomes ever more acute. We much prefer that the Task Force follow its own wisdom at pages 21-22 and page 18 of the draft, to wit:

> "Despite many studies and varied policies and programs, a strong sense of uncertainty about the effects of human actions is still the most accurate characterization of our understanding of the Delta today.
>
> "Far from being a prescription for paralysis, however, recognizing both uncertainty in knowledge and uncertainty about outcomes of policies and programs has very specific implications for future Delta management. Managing a valuable resource of any kind under conditions of uncertainty calls for common sense wisdom—spread risks, create backups where possible, work in reversible steps, and learn from experience. The State of California must act decisively and deliberatively to reduce known threats, but must also adopt a long-range stewardship philosophy that results in a resilient Delta environment and resilient water supply for California".
>
> "In a system as dynamic as the Delta, and with climatic and other conditions changing in unpredictable ways, it is essential that management flexibility be preserved and exercised. This may mean creating multiple pathways for water conveyance so critical water supplies cannot be interrupted completely by levee failures, salinity intrusion, or other sudden changes. "

We are now eager to move forward with the Delta Vision in developing the requisite design, operational and governance criteria as expeditiously as possible.

Respectfully submitted,

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Non-Profit Law and Science for Global Resource Solutions

October 5, 2007

Memo To: BDCP Members

From: John Cain, NHI

Re: Delta Conveyance Options

This memo is a draft product intended to facilitate consensus among BDCP members on a path forward. It is not a specific proposal or definitive analysis. NHI welcomes comments and suggestions.

This memo conducts a preliminary sensitivity analysis to determine which conveyance strategies are most robust against the universe of probable stressors and identifies a phased conveyance approach that warrants further analysis.

The optimal conveyance option will vary depending upon the problem you are trying to solve. Scientists have proposed several competing hypothesis regarding which stressors (problems) are the most important factors in the decline of covered species. At this point in the BDCP planning process, it is extremely difficult to envision, and more importantly, evaluate conservation options that address several competing hypothesis. Narrowing the problem statement down to the most important elements (assumed priority stressors) is necessary to focus design and evaluation of conservation measures. Clarifying the problem statement, prioritizing objectives[1] and subjecting them to scientific review is an essential next step in the planning process.

Sensitivity Analysis

At this time, however, it may be possible to identify which conveyance options are flexible enough to address a large range of competing hypothesis and objectives. Going through the exercise of conceptually developing several separate conservation measures to address different hypotheses and objectives could help identify conveyance strategies that effectively address a broad range of potential stressors.

Table1 and appendix A are an initial attempt to evaluate which conveyance options are most robust across a broad range of general problem statements. Each option evaluated here is

[1] I am not referring to "conservation objective" under endangered species law, but rather to the broad definition of the work objective.

designed to address a different problem or set of problems related to conveyance or conveyance sensitive conservation measures.[2]

This *preliminary* sensitivity analysis suggests that the existing conveyance system is incompatible with achieving several objectives.[3] While an isolated facility is optimal for addressing several stressors, it is incompatible with maintaining south Delta water quality.[4] An isolated facility may also be incompatible with maximizing flexibility to respond to uncertainty. The eco-crescent option which isolates Old River from the influence of the pumps and focuses diversions from Middle River is compatible with all potential objectives, but is not optimal for any. Dual conveyance, on the other hand, is optimal for addressing several problems and is compatible with addressing all potential problems. Moreover, a dual conveyance facility could be sized large enough to provide the benefits of an isolated facility while still retaining advantages for managing uncertainty and water quality.

In addition, dual, isolated, and middle river (eco-crescent) conveyance approaches all provide superior drinking water quality and seismic risk reduction benefits relative to existing conveyance. All three would protect the state water supply from salinity intrusion caused by seismic levee failure, but the isolated and dual approaches would provide a greater level of protection. On the other hand, the middle river conveyance option could be built sooner and for less money and thereby could provide more timely and cost effective water quality and risk reduction benefits.

This analysis demonstrates that the definition of an optimal conveyance strategy depends on the definition of the problem the conveyance strategy is designed to address. The hypothetical problem statements and objectives listed in table 1 are very broad. More detailed problem statements such as those listed in table 2 are necessary to further refine, evaluate, and optimize the conveyance approach.

Recommended Option for Further Analysis

Based on the cursory analysis above and discussions with several BDCP members, we recommend a phased approach that focuses on further analysis and development of the eco-crescent and dual conveyance approaches. A dual facility would provide the most flexibility for managing a broad range of problems, but would take many years to design, permit, and build. Some variation or portion of the eco-crescent crescent concept could be implemented much sooner. Early implementation of the eco-crescent concept[5] would provide interim water quality, seismic risk reduction, and entrainment reduction benefits. Management of residence time and water quality in Old River under the eco-crescent approach will generate

[2] Conveyance sensitive measures are decisions that may vary depending upon how conveyance infrastructure is configured or operated. For example, judgments regarding the location, effectiveness, and impacts of tidal marsh restoration will vary depending upon the location of the point of diversion. Table 2 provides a list of conveyance sensitive and conveyance neutral conservation measures.

[3] Assuming water diversions are not substantially reduced from historical levels.

[4] Assuming it is not possible to substantially increase San Joaquin inflows.

[5] There are probably a dozen or more variations on how to configure the eco-crescent approach and an infinite number of ways to operate it.

useful information on how to operate a dual facility and enable modelers to better calibrate their models. The combined information and model improvements will help design and refine configuration and operations of a future dual facility.

There are many different ways to configure either the dual or eco-crescent conveyance approaches and there are probably an infinite number of ways to operate each of these approaches. At this point, it is probably counterproductive to commit to a particular configuration or operation. For the purpose of focusing future BDCP planning and analysis, however, it is important to identify the indispensable characteristics of the dual and eco-crescent approaches that render them worthy of further analysis.

1. A dual facility allows for the diversion of water from at least two locations, one in the north and one in the south. It might be operated to preferentially divert from one location, but is designed to allow for diversion from both.
2. The eco-crescent option allows water managers to isolate Old River, at least seasonally, from the deleterious effects of the diversion facilities.
3. Dual facility would build on eco-cres
4. The eco-crescent option can be implemented and operated in a phased, adaptable approach, and the dual facility can be operated in an adaptable approach. Phasing and operational flexibility provide opportunities for adaptive management experiments that could allow managers to learn and improve management over time as conditions change.
5. The eco-crescent can be implemented in the near term as a first step in the development of a dual facility over the long-term and will serve as a valuable component of a dual system.

Hybrid Scenario: Conveyance plus Essential Conservation Measures
Below is an example of a hybrid scenario built around a dual conveyance approach. It focuses on a relatively narrow problem statement, identifies key assumptions, and is designed to achieve specific objectives.

Assumed General Problem Statement:

Entrainment induced fish mortality combined with lack of food and rearing habitat are the primary causes of the decline in covered fish species. Entrainment also limits food both directly by entraining food resources and indirectly by reducing residence times necessary for primary productivity. The lack of inundated floodplain and tidal marsh habitat limits both food production and critical rearing habitat, particularly, for juvenile salmon and splittail. The overall level of diversions (in the Delta and upstream) in drier year types may aggravate the primary problem identified above or reduce degraded habitat conditions in Suisun Bay due to lack of outflow.

Assumptions:

1. The eco-crescent option effectively eliminates reverse flows and entrainment in Old River but increases reverse flows in Middle River. Reverse flows in Middle River,

however, may not entrain San Joaquin and Mokelumne River fish if net flows in the San Joaquin River at its confluence with Middle River remain positive.

2. Changes in residence ties could harm water quality and endangered fish. An isolated facility, or large dual facility, that only diverted water from the north Delta and which did not also clean-up or substantially increase flows from the San Joaquin River would uncontrollably degrade water quality in the South and Central Delta.
3. Fish screens to limit entrainment will be far more effective at a river diversion where substantial water flows past the diversion facility. Fish screens at the existing south Delta diversion facilities will not be effective because they are terminal diversion facilities that will repeatedly draw fish and nutrients into the entrainment hazard.
4. Hundreds of thousands of acres of tidal marsh and inundated habitat have been lost, but there are a very limited number of locations where you can restore tidal marsh or inundated floodplain habitat in the Delta
5. Intertidal marsh can provide food and rearing habitat during all seasons and in all year types. Benefits from inundated floodplain habitat are equally important, but are currently limited to wet years and spring months. Increasing the frequency of inundation to normal year types and the duration in (45 days or greater) will substantially improve spawning and rearing habitat for splittail and rearing habitat for salmon.
6. Habitat restoration (tidal marsh or flood plain) in an entrainment zone is an attractive nuisance for entrainment prone fish and bad for drinking water quality.
7. Restoring channels or floodplain corridors that bypass diversion points, at least seasonally, both increase the area of habitat and creates entrainment-free migration corridor.
8. Maintaining net positive flows at the junction of the Mokelumne and San Joaquin Rivers will substantially reduce entrainment via the Middle River corridor.

General Objectives:

1. Minimize entrainment of fish and food at existing and new export water diversions.
2. Substantially increase pelagic food resources (zooplankton) through habitat restoration and measured increases in residence time.
3. Substantially increase the area of dendritic, intertidal emergent marsh and seasonally inundated floodplain habitat.

Conservation Measures:

1. Diversify and screen points of diversion to substantially reduce entrainment.
2. Inundate floodplains when food is most needed for recruitment of pelagic fish.
3. Large scale floodplain restoration in both the north and south Delta. Floodplains inundated during the late winter and early spring of most years to provide rearing habitat and create a migration corridor around the principal diversion points. In the North Delta, out-migrating juveniles largely avoid diversion points by migrating through Yolo bypass or through new Stone Lakes/McCormack Williamson corridor. In the South Delta, out-migrants largely use the Old River corridor and traverse floodplain and tidal marsh habitats along the Paradise Cut/Stewart Tract and Fabian Tract corridor.

4. Major tidal marsh restoration in the Cache Slough area, west Delta, Stone Lakes-McCormack corridor and Paradise Cut-Old River corridor.

Conveyance Strategy:

1. Dual conveyance facility with diversions at hood and the south Delta. South Delta diversion designed with new, short siphon under Old River per suggestion of Contra Costa Water District[6] and gates between Old and Middle Rivers to isolate Old River from the impacts of the pumps. This is necessary to allow effective habitat restoration along Old River corridor.
2. Pumps operated to maximize diversion in wet years from both diversion points, reduce diversion in dry years, minimize entrainment during winter and spring, and maintain south Delta water quality during summer and fall (either to reduce salinity or to reduce concentrations of toxins).
3. South Delta diversion facility designed to take water exclusively from Middle River, but designed with capacity to divert Old River flows traveling past Clifton Court during very wet periods. Screen may be necessary for Old River diversion.

Key Questions:

1. How large should the new pipe or canal that diverts water from the north Delta be?
2. What type of water quality problems are likely to arise and what strategies could be employed to avoid or mitigate?
3. Which gates, structures, and facilities are essential and which are least cost effective? The eco-crescent gate on the northeast corner of Franks Tract would be very large, expensive, and unpopular with boaters. Is it really necessary.
4. Where should the north diversion point be located? Is Hood far enough upstream to avoid negative tidal influence and associated entrainment problems even under sea level rise scenarios?

Configuration and Operation Scenarios:

There are many ways you could configure or operate eco-crescent or dual conveyance. Under some scenarios both conveyance strategies may perform effectively. Under other scenarios, these same strategies may perform poorly. Therefore, it is important to run promising options under a variety of different scenarios. To illustrate this point, we have

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[6] Construct a barrier at the south end of Victoria canal, which is also the start of the siphon, which would siphon into a new canal on Coney Island (just under Old River and onto the island); that canal would lead directly to West Canal (along the west side of Coney Island, and of course, east side of Clifton Court Forebay (CCFB). West Canal would have barriers at both ends (which, like the South Delta Barriers could be operated. Normally the North Barrier would be closed, and the south barrier would allow water to flow out of west canal (not in) and into Old River.

The levee on CCFB along west canal would have positive barrier fish screen and the fish left in west canal would travel to the south end and out the barrier, into Old River where they are safe from the pumps. Except for the screen, all this can be tried out relatively cheaply. Tracy would connect to CCFB. CCWD tests show that with dredging in Victoria Canal and Middle River you can get more than 8000 cfs (we stopped at 8000) into CCFB provided the losses in the siphon are sufficiently small, which they can be with a short distance envisioned here.

identified some of the different scenarios and assumptions that should be run for this dual conveyance option.

- Size of pipe or canal: run ball park scenarios assuming 2,500; 7,500 c.f.s, and 15,000 cfs to understand trade offs associated with diversion capacity.
- Evaluate different strategies for avoiding or mitigating water quality impacts such as pumping preferentially from south Delta during late summer or discharging from the California aqueduct into the San Joaquin River via Newman wasteway during critical months.
- Evaluate with different configuration of gates and siphon for eco-crescent. To the extent possible, avoid expensive large gates that would interfere with boating such as the gate between Franks Tract and Middle River.
- Evaluate different intake locations for the north Delta. Consider two separate north Delta intakes.

Table 1: Summary Results of Conveyance Strategy Sensitivity Analysis[7]

Hypothetical Problem	Restoration Objective	Conservation Measure(s)	Compatible Conveyance Strategy	Optimal Conveyance Strategy	Incompatible Conveyance Strategy
A. Habitat loss	Restore thousands of acres of habitat throughout the Delta	Restore floodplain and tidal marsh in all regions of the Delta.	Isolated, dual, or eco-crescent.	Isolated	Existing
B. Entrainment of fish and food	Reduce entrainment	Install fish screens, move diversion point, maintain net positive at SJ/Mokelumne confluence	Isolated, dual, or eco-crescent.	Isolated	Existing
C. Invasive, exotic species thrive in altered salinity regime	Restore natural salinity regime	Change patterns of inflow and outflow	Isolated, dual, or eco-crescent.	Isolated	Existing
D. Reduced total out flow from Delta	Increase total outflow	Reduce upstream diversions, reduce Delta diversions.	Conveyance neutral.	N/A	None
E. Reduction in Delta outflow in drier years	Increase outflow in drier years	Reduce upstream diversions or reduce Delta diversions in drier years and offset reductions with more diversions in wet years.	All	Dual	None
F. Upstream hydrograph alteration	Restore or mimic natural upstream hydrograph.	Re-operate upstream reservoirs and adjust diversion patterns to take and store more water when available.	All with south of Delta storage	Dual with south of Delta storage	None
G. Poor water quality in south and central Delta	Improve water quality, reduce exposure to toxics	Dilute pollutants with freshwater inflow, decrease residence times	Dual, eco-crescent, or existing	Existing	Isolated
H. Lack of food due to low residence times	Increase residence times	Change point of diversion, create dead-end sloughs	Isolated, dual, or eco-crescent.	Isolated	Existing
I. Lack of food due to loss of floodplain	Restore floodplain habitat	Reconnect rivers and floodplains, re-operate reservoirs.	Isolated, dual, or eco-crescent.	Isolated	Existing
J. Scientific uncertainty	Reduce uncertainty and avoid irreversible actions	Maximize potential for flexible adaptive management	Dual, eco-crescent, existing	Dual	Isolated

[7] This analysis assumes that water diversions from the Delta will remain similar to historic levels except under option D which reduces total exports.

Table 2: Example of the level of detail needed in problem statement in order to guide development of objectives and strategies

Problem/Stressor	**Objective**	**Potential Conservation Measure**	**Compatible Conveyance Strategy(s)**
Reduced Delta outflow	Increase Delta outflow	o Increase reservoir releases o Decrease upstream diversions o Decrease delta diversions	All
Reduced Delta outflow in drier years	Increase Delta outflows in drier years	o Decrease upstream diversions o Decrease delta diversions	All
Entrainment of juvenile smelt from reverse flows in Old River	Decrease reverse flows in Old river when juveniles present	o Reduce diversions February – June o Change point of diversion to enable diversion without reverse flows in Old River o Remove head of Old River barrier	All Middle River,
Entrainment of juvenile smelt from reverse flows in Middle River	Decrease reverse flows in Old river when juveniles present	o Reduce diversions February – June o Change point of diversion to enable diversion without reverse flows in Middle River o Remove head of Old River barrier	All Dual, or Isolated
Entrainment of SJ juvenile salmon via Old River	Decrease entrainment hazard in Old River	o Install barrier at head of Old River o Change point of diversion to enable diversion without reverse flows in Middle River	Existing Middle, Dual, or Isolated
Poor water quality in south Delta	Improve south Delta water quality	o Improve water quality inflow from San Joaquin o Dilute south Delta water with Sacramento water	All Middle, Dual, or Isolated
Lack of food due to entrainment of food resources (when)	Reduce entrainment of food	o Reduce diversion o Change point of diversion	All
Lack of food due to reduced residence time	Increase residence times in all	o Increase residence time in south Delta o Increase residence time in Georgiana/Mokelumne o Increase residence time in west Delta	

	parts of Delta	o Increase residence time in Central Delta o Increase residence time in northwest Delta (Cache Slough)	
Lack of food due to competition from Corbicula clam	Increase food supply available to fish	o Not sure how to do this. o Increase residence time)may only increase fish for Corbicula).\	
Competition from Corbicula	Reduce Corbicula or their competitive advantage	o Change salinity fluctuation regime	Dual, Middle, or Isolated

Appendix A

Option A: Habitat Loss is the Primary Problem

Assumed Problem Statement:
Loss of floodplain and tidal marsh habitat in both the south and north and the food supply generated in these habitats is the primary cause of species decline.

Objective:
Restore tens of thousands of acres of tidal marsh and inundated floodplain habitat.

Assumptions:

1. Hundreds of thousands of acres of tidal marsh and inundated habitat have been lost, but there are a very limited number of locations where you can restore tidal marsh or inundated floodplain habitat in the Delta due to subsidence, urbanization, and upstream dams.
2. Habitat restoration (tidal marsh or flood plain) in an entrainment zone is an attractive nuisance for entrainment prone fish, entrains food resources, and is bad for drinking water quality.
3. San Joaquin flows are barely sufficient to sustain San Joaquin fish and the BDCP does not have the ability to increase flows from San Joaquin and tributaries.

Conservation Measures:

5. Move diversion point away from and upstream of habitat restoration areas.
6. Large scale floodplain restoration in both the north and south Delta. Floodplains inundated during the late winter and early spring of most years to provide rearing habitat and create a migration corridor around the principal diversion points. In the North Delta, out-migrating juveniles largely avoid diversion points by migrating through Yolo bypass or through new Stone Lakes/McCormack Williamson corridor. In the South Delta, out-migrants largely use the Old River corridor and traverse floodplain and tidal marsh habitats along the Paradise Cut/Stewart Tract and Fabian Tract corridor.
7. Major tidal marsh restoration in the Cache Slough area, west Delta, Stone Lakes-McCormack corridor and Paradise Cut-Old River corridor.

Conveyance Strategy:

1. Construct isolated facility on Sacramento upstream of restored habitat (Hood or Freeport) sites to reduce conflicts between habitat restoration and water diversion.

Option B: Entrainment is the Primary Problem

Assumed Problem Statement: Entrainment of Delta smelt and juvenile salmon is the primary problem.

Objective: Reduce entrainment

Assumptions:

1. Fish screens will largely reduce entrainment and will be far more effective when located on channels with substantial, unidirectional bypass flows.

2. San Joaquin flows are barely sufficient to sustain positive flows through the Delta in most months and the BDCP does not have the ability to increase flows from San Joaquin and tributaries.

Conservation Measures:
1. Install fish screen.
2. Move diversion point to channel with high potential for unidirectional, bypass flows.

Conveyance Strategy:
1. Isolated facility on Sacramento River outside of tidal zone – probably at Freeport.

Option C: Invasive exotic species are the Primary Problem

Assumed Problem Statement: Exotic species have a competitive advantage under the existing salinity fluctuation regime.

Assumptions:
1. Native species would compete more favorably if salinity fluctuated more widely.
2. Substantial changes in the salinity regime would be incompatible with the existing conveyance regime. If salinity changes don't reduce exotics, then the exotics problem would be insensitive to conveyance decisions. No particular conveyance strategy or diversion pattern would reduce exotics.

Objective: Change salinity regime to benefit native species.

Conservation Measures: Fluctuate salinity (pattern to be determined through adaptive management.

Conveyance Strategy: Isolated facility on the Sacramento River.

Option D: Reduction in total Delta outflow is the primary problem

Assumed Problem Statement: Reduction in Delta outflow all years reduces habitat for native species in Suisun Bay leading to their overall decline.

Objective: Increase the amount of water flowing out the Golden Gate.

Conservation Measures: Decrease diversions

Conveyance Strategy: Conveyance neutral. Reducing diversions is compatible with all conveyance options.

Option E: Reduction in Delta outflow drier years.

Assumed Problem Statement: Reduction in Delta outflow in drier years reduces habitat for native species in Suisun Bay leading to their overall decline.

Assumptions:

Objective: Increase the amount of water flowing out the Golden Gate.

Conservation Measures: Decrease diversions in drier years

Conveyance Strategy: Potential compatible with all diversion strategies but would probably work best with a dual conveyance system which would allow large exports during wet years. Maintaining total diversion would require increased wet year diversions to offset reductions in dry year diversions. This could require greater ability to convey from north to south across the Delta along with increased South of Delta storage.

Option F: Reservoir induced changes in upstream hydrographs is the primary problem

Assumed Problem Statement: Reservoir operation has unnaturally inverted the hydrograph resulting in unnaturally high flows in July and August and unnaturally low flows in Marsh and April in the upstream rivers. Most native species including fish, amphibians, invertebrates, and vegetation have evolved under a different flow regime with maximum annual flows in the spring and minimal flows in the late summer and early fall. This change in the hydrograph is the primary reason for native species decline.

Assumptions: The unnatural hydrographs on the Sacramento Basin rivers are primarily driven by export and water quality rules in the Delta.

Objective: Restore or mimic natural hydrograph with greatest flows in spring and smallest flows in the late summer and fall.

Conservation Measures: Re-operate upstream reservoirs.

Conveyance Strategy: Increase diversion and storage capacity to allow for increased diversions during spring for storage until summer when the water is needed for agriculture. This would probably require a dual conveyance strategy.

Option G: Poor water quality (salts, metals, and synthetic chemicals)

Assumed Problem Statement: Poor water quality, particularly in the South and Central Delta is the primary cause of the decline of native species and their food resources. Acute and chronic pollution by toxic salts and metals along with inorganic chemicals creates both lethal and sub lethal effects at all trophic levels.

Assumptions:

1. Most of the pollutants come from San Joaquin and in-Delta non-point urban and agricultural sources that BDCP is relatively powerless to control.
2. The scope of the problem is currently limited by dilution effects of Sacramento River water under existing conveyance scenario.
3. Increased residence times will increase adverse impacts of poor water quality and may lead to noxious algae blooms.
4. The BDCP cannot require increased flows from the San Joaquin river to flush out poor water quality in the south Delta.

Objective: Improve water quality in the South and Central Delta.

Conservation Measures: Maintain flow of freshwater from Sacramento River south through Delta.

Conveyance Strategy: Through Delta (existing) conveyance or dual conveyance. Without increased inflow for the San Joaquin, improving water quality in the south Delta would be incompatible with isolated facility which would reduce flushing from Sacramento and increase residence times.

Option H: Lack of food due to changes in residence time of Delta waters

Assumed Problem Statement: Decreases in residence time of Delta waters has reduced primary productivity and food resources for native species. The south Delta diversion point along with changes in channel configuration has reduced residence time by continually moving water into the diversion intake.

Objective: Increase residence time.

Conservation Measures:

1. Move the point of diversion out of the tidal Delta so that residence time of tidal water is not decreased by diversions.
2. Reconfigure channels to create more dead-end sloughs.

Conveyance Strategy: Isolated facility

Option I: Lack of food due to loss of inundated floodplain habitat

Assumed Problem Statement: Loss of food resources in the Delta due to loss of inundated floodplain habitat on upstream rivers.

Assumptions: Lack of floodplain habitat is caused by both levees that disconnect floodplains from the rivers and reservoir operations that reduce peak flows.

Objective: Increase the frequency and area of inundated habitat.

Conservation Measures:

1. Modify or remove levees and weirs to allow bypasses and other floodplains to be inundated at lower flows, and thereby restore floodplains on Sutter Bypass, Yolo Bypass, Stone Lakes/McCormack corridor, and Paradise Cut/Stewart Tract corridor.
2. Reoperate reservoirs to increase the frequency during which flow are sufficient to inundate floodplains.
3. Minimize entrainment of food resources generated on floodplain into water diversions.

Conveyance Strategy: Isolated facility would entrain the least food resources. Dual facility which isolates Old River may also perform.